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IS 9000-19-1 to 5 (1986): Basic Environmental Testing Procedures for Electronic and Electrical Items, Part 19: Test U: Robustness of Terminations and Integral Mounting Devices (Sections 1-5) [LITD 1: Environmental Testing Procedure]



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IS : 9000 (Part 19/Sec 1 to 5) - 1986

Indian Standard

**BASIC ENVIRONMENTAL
TESTING PROCEDURES FOR
ELECTRONIC AND ELECTRICAL ITEMS**

**PART 19 TEST U : ROBUSTNESS OF TERMINATIONS
AND INTEGRAL MOUNTING DEVICES**

(First Revision)

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**BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002**

Indian Standard

BASIC ENVIRONMENTAL TESTING PROCEDURES FOR ELECTRONIC AND ELECTRICAL ITEMS

PART 19 TEST U : ROBUSTNESS OF TERMINATIONS AND INTEGRAL MOUNTING DEVICES

(First Revision)

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BASIC ENVIRONMENTAL TESTING PROCEDURES FOR ELECTRONIC AND ELECTRICAL ITEMS

PART 19 TEST U : ROBUSTNESS OF TERMINATIONS AND INTEGRAL MOUNTING DEVICES

(First Revision)

0. FOREWORD

0.1 This Indian Standard (Part 19/Sec 1 to 5) (First Revision) was adopted by the Indian Standards Institution on 28 August 1986, after the draft finalized by the Environmental Testing Procedures Sectional Committee had been approved by the Electronics and Telecommunication Division Council.

0.2 The differences in environmental testing procedures for component type items and equipment type items are fast disappearing in the context of technological developments. It is, therefore, felt necessary to have uniform testing procedures wherever possible. This series of standards on environmental testing procedures (IS : 9000) has been prepared with this objective. This is also in line with the principle adopted by IEC/TC 50 'Environmental Testing' in developing unified series of standards on environmental testing procedures by International Electrotechnical Commission.

0.3 During normal manufacturing operations, components with either wire or tag terminations may be subjected to mechanical stresses which can have:

- a) an immediate effect, causing breakage or displacement of the termination; and
- b) a long-term effect, by breaking or weakening a seal, where the termination enters the body of the component, and thereby affecting the useful life of the component, for example, electrical deterioration due to ingress of moisture.

Mounting or fixing screws, threaded studs or holes, or other mounting devices attached to the body of the component may give rise to similar conditions.

Such defects are likely to occur also during normal dismantling or assembly or handling or inspection operations or during servicing after installation.

It is, therefore, considered necessary to ensure that the mechanical stresses that these items have to endure in normal manufacture and use should be applied to prove their suitability for their intended application.

0.4 This standard covers the test procedures for determining the ability of terminations or integral mounting devices to withstand forces or stresses that are likely to be applied during normal assembly or handling or dismantling operations or during inspection or servicing after installation.

0.4.1 This standard shall be read in conjunction with IS : 9000 (Part 1)-1977*.

0.5 The following tests specified in this standard give simple, reproducible methods for determining the ability of terminations and integral mounting devices to withstand such forces:

- a) Tensile (*see* Section 1)
- b) Thrust (*see* Section 2)
- c) Bending (*see* Section 3)
- d) Torsion (*see* Section 4)
- e) Torque (*see* Section 5)

0.5.1 The tests specified in this standard are normally applicable to component type items.

0.5.2 The tests applicable and distribution of samples for the various tests shall be specified in the relevant specification.

0.6 In preparing this standard, assistance has been derived from IEC Pub 68-2-21 (1983) 'Basic environmental testing procedures: Part 2 Tests, Test U: Robustness of terminations and integral mounting devices', issued by the International Electrotechnical Commission (IEC).

0.7 In reporting the result of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS : 2-1960†.

*Basic environmental testing procedures for electronic and electrical items: Part 1 General.

†Rules for rounding off numerical values (*revised*).

Indian Standard

BASIC ENVIRONMENTAL TESTING PROCEDURES FOR ELECTRONIC AND ELECTRICAL ITEMS

PART 19 TEST U : ROBUSTNESS OF TERMINATIONS AND INTEGRAL MOUNTING DEVICES

Section 1 Test Ua₁ : Tensile

(First Revision)

1. SCOPE

1.1 This standard (Part 19/Sec 1) (First Revision) covers the test procedure for determining the ability of terminations and integral mounting devices to withstand axial stresses that are likely to be applied during normal assembly or handling operations.

NOTE — This test is applicable to all types of terminations.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions and explanation of terms given in IS : 9000 (Part 1)-1977* shall apply.

3. OBJECT

3.1 The object of this test is to determine that the terminations and attachment of the terminations to the body of the component shall withstand tensile stresses as are likely to be applied during normal assembly or handling operations.

4. GENERAL DESCRIPTION OF TENSILE TEST

4.1 With the termination in its normal position and the component held by its body, a force is applied to the termination in the direction of its axis and acting in a direction away from the body of the component.

The force shall be applied gradually (without any shock) and then maintained for a period of 10 ± 1 s.

*Basic environmental testing procedures for electronic and electrical items: Part 1 General.

5. PRECONDITIONING

5.1 The method of preconditioning shall be as prescribed in the relevant specification.

6. INITIAL MEASUREMENTS

6.1 The item shall be visually inspected and electrically and mechanically checked, as required by the relevant specification.

7. TEST METHOD

7.1 **Application** — This test applies to all types of terminations. It shall be carried out on all the terminations, except that where a component has more than three terminations, the specification shall state the number of terminations per component to be tested. The test shall be carried out in such a manner that all the terminations of the component shall have an equal probability of being subjected to the test.

7.2 **Procedure** — With the termination in its normal position and the component held by its body, a force having a value as specified in Table 1 shall be applied to the termination in the direction of its axis and acting in a direction away from the body of the component (*see* Fig. 1). The force shall be applied gradually (without any shock) and then maintained for a period of 10 ± 1 s.

TABLE 1 VALUES OF FORCE

(*Clauses 7.2 and 7.3*)

NOMINAL CROSS-SECTIONAL AREA*	CORRESPONDING DIAMETER FOR CIRCULAR SECTION WIRE	FORCE
(1)	(2)	(3)
mm ²	mm	N
$S < 0.05$	$d \leq 0.25$	1
$0.05 < S \leq 0.01$	$0.25 < d \leq 0.35$	2.5
$0.01 < S \leq 0.2$	$0.35 < d \leq 0.5$	5
$0.2 < S \leq 0.5$	$0.6 < d \leq 0.8$	10
$0.5 < S \leq 1.2$	$0.8 < d \leq 1.25$	20
$S > 1.2$	$d > 1.25$	40

NOTE — For components with oversized wire terminations, the appropriate force should be given in the relevant specification.

*For Circular Section Wires, Strips of Pins — The nominal cross-sectional area is equal to the value calculated from the nominal dimension(s) given in the relevant specification.

For Stranded Wires — The nominal cross-sectional area is obtained by taking the sum of the cross-sectional area of the individual strands of the conductor specified in the relevant specification.

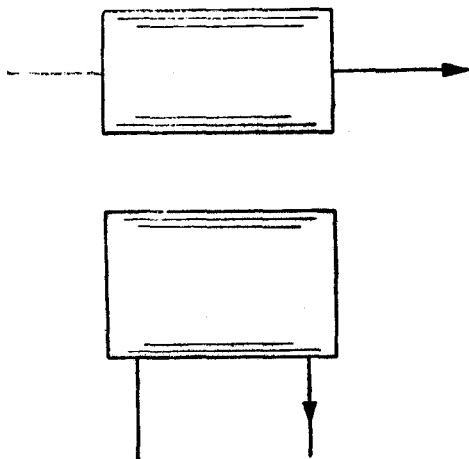


FIG. 1 SKETCHES SHOWING DIRECTION OF APPLICATION OF FORCES,
WITH RESPECT TO BODY, INDICATED BY ARROW HEADS,
TEST U_{a1} : TENSILE

7.3 Value of Applied Force

- a) *Wire Terminations (Circular Section or Strip) or Pins* — The value of the force applied shall be as given in Table 1.

Insulated Wires shall be stripped of the insulation at the point at which the load is applied.

Stranded Wires — The strands shall be united mechanically at the point of application of the load (such as by soldering or knotting), prior to the application of the load.

Where the technical features of insulated wires or stranded wires may give rise to difficulties during the stripping, joining or knotting operations, liable to cause dispute as to the results of the test, such operations shall be in accordance with the relevant specification or, where necessary, with the recommendations of the component manufacturer.

- b) *Other Terminations (Tag Terminations, Threaded Studs, Screws, Terminals, etc)* — The value of the force to be applied shall be as given in the relevant specification.

8. FINAL MEASUREMENTS

8.1 The item shall be visually inspected, and electrically and mechanically checked, as required by the relevant specification.

9. INFORMATION TO BE GIVEN IN THE RELEVANT SPECIFICATION

9.1 When this test is included in the relevant specification, the following details shall be given as far as they are applicable:

- a) Preconditioning procedure, if any (*see 5*);
- b) Initial measurements (*see 6*);
- c) Number of terminations to be tested if there are more than three (*see 7.1*);
- d) Force (for oversized and other terminations) [*see 7.3(a)*];
- e) Details of stripping, joining or knotting operations, if necessary [*see 7.3(b)*];
- f) Final measurements (*see 8*); and
- g) Any deviation in procedure as agreed to between the purchaser and the manufacturer.

Indian Standard

BASIC ENVIRONMENTAL TESTING PROCEDURES FOR ELECTRONIC AND ELECTRICAL ITEMS

PART 19 TEST U : ROBUSTNESS OF TERMINATIONS AND INTEGRAL MOUNTING DEVICES

Section 2 Test Ua₂ : Thrust

(First Revision)

1. SCOPE

1.1 This standard (Part 19/Sec 2) (First Revision) covers the test procedure for determining the ability of terminations and integral mounting devices to withstand thrusts that are likely to be applied during normal assembly or handling operations.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions and explanation of terms given in IS : 9000 (Part 1)-1977* shall apply.

3. OBJECT

3.1 The object of this test is to determine that the terminations and the attachment of the termination to the body of the component shall withstand thrusts such as are likely to be applied during normal assembly or handling operations.

This test applies only to items of small dimensions and of low mass, to the exclusion of equipment and assemblies.

NOTE — This test should not be applied to flexible terminations.

*Basic environmental testing procedures for electronic and electrical items: Part 1 General.

4. GENERAL DESCRIPTION OF THRUST TEST

4.1 With the termination in its normal position and the component held by its body, thrust is applied to the termination as close as possible to the body of the component, but there should be a clear 2 mm of distance between the body of the component and the nearest point of the device applying the force.

The force shall be applied gradually (without any shock) and then maintained for a period of 10 ± 1 s.

5. PRECONDITIONING

5.1 The method of preconditioning shall be as prescribed in the relevant specification.

6. INITIAL MEASUREMENTS

6.1 The item shall be visually inspected, and electrically and mechanically checked, as required by the relevant specification.

7. TEST METHOD

7.1 Application — This relevant specification shall state whether this test is applicable.

When applicable, the test shall be carried out on all the terminations, except that where a component has more than three terminations, the specification shall state the number of terminations per component to be tested. The test shall be carried out in such a manner that all the terminations of the component shall have an equal probability of being subjected to the test. The relevant specification shall prescribe, using diagrams, if necessary, the direction in which the thrust is to be applied to the termination.

7.2 Procedure — With the termination in its normal position and the component held by its body, thrust shall be applied to the termination as close as possible to the body of the component, but there should be a clear 2 mm of distance between the body of the component and the nearest point of the device applying the force (*see* Fig. 1). The force shall have a value as stated in Table 1. The force shall be applied gradually (without any shock) and then maintained for a period of 10 ± 1 s.

7.3 Value of Applied Force

- a) *Wire Terminations (Circular Section or Strip) or Pins* — The value of the force applied shall be as given in Table 1.

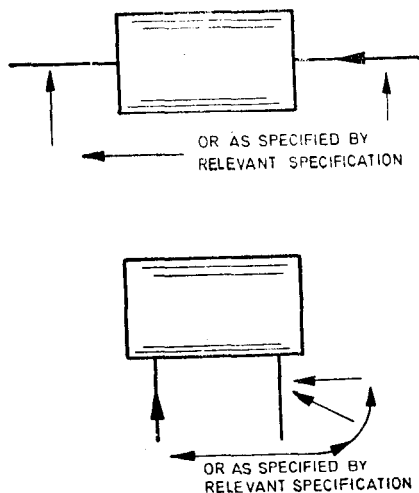


FIG. 1 SKETCHES SHOWING DIRECTION OF APPLICATION OF FORCES,
WITH RESPECT TO BODY, INDICATED BY ARROW HEADS,
TEST U_{a_2} : THRUST

TABLE 1 VALUES OF FORCE

(Clauses 7.2 and 7.3)

NOMINAL CROSS- SECTIONAL AREA*	CORRESPONDING DIAMETER FOR CIRCULAR SECTION WIRES	FORCE
(1) mm ²	(2) mm	(3) N
$S < 0.05$	$d \leq 0.25$	0.25
$0.05 < S < 0.01$	$0.25 < d \leq 0.35$	0.5
$0.01 < S < 0.2$	$0.35 < d \leq 0.5$	1
$0.2 < S < 0.5$	$0.5 < d \leq 0.8$	2
$0.5 < S < 1.2$	$0.8 < d \leq 1.25$	4
$S > 1.2$	$d > 1.25$	8

*For Circular Section Wires, Strips or Pins — The nominal cross-sectional area is equal to the value calculated from the nominal dimension(s) given in the relevant specification.

The insulated wires shall be stripped of the insulation at the point at which the load is applied.

Where the technical features of insulated wires may give rise to difficulties during the stripping, liable to cause dispute as to the results of the test, such operations shall be in accordance with the relevant specification or, where necessary, recommendations of the component manufacturer.

- b) *Other Terminations (Tag Terminations, Threaded Studs, Screws, Terminals, etc)* — The value of the force to be applied shall be as given in the relevant specification.

8. FINAL MEASUREMENTS

8.1 The item shall be visually inspected, and electrically and mechanically checked, as required by the relevant specification.

9. INFORMATION TO BE GIVEN IN THE RELEVANT SPECIFICATION

9.1 When this test is included in the relevant specification, the following details shall be given as far as they are applicable:

- a) Preconditioning procedure, if any (*see 5*);
- b) Initial measurements (*see 6*);
- c) Whether the test is applicable (*see 7.1*);
- d) Number of terminations to be tested if there are more than three (*see 7.1*);
- e) Direction of applied force (*see 7.1*);
- f) Details of stripping, if necessary [*see 7.3 (a)*];
- g) Applied force required for terminations other than wires or pins [*see 7.3 (b)*];
- h) Final measurements (*see 8*); and
- j) Any deviation in procedure as agreed upon between the purchaser and the manufacturer.

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BASIC ENVIRONMENTAL TESTING PROCEDURES FOR ELECTRONIC AND ELECTRICAL ITEMS

PART 19 TEST U : ROBUSTNESS OF TERMINATIONS AND INTEGRAL MOUNTING DEVICES

Section 3 Test Ub : Bending

(First Revision)

1. SCOPE

1.1 This standard (Part 19/Sec 3) (First Revision) covers the test procedure for determining the ability of terminations and integral mounting devices to withstand such bending forces as are likely to be applied during normal assembly or handling operations.

NOTE — Applicable to pliable terminations only.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions and explanation of terms given in IS : 9000 (Part 1)-1977* shall apply.

3. OBJECT

3.1 The object of this test is to determine that pliable terminations and the attachment of these terminations to the body of the component shall withstand such bending loads as are likely to be applied during normal assembly and handling operations.

3.1.1 In order to be considered pliable, the following conditions shall apply:

- a) Bending (wire or strip termination) (*see 7.2.1*) and simultaneous bending (*see 7.2.3*) — The termination shall assume, during the course of the test, a displacement of at least 30° with respect to its initial position (*see Fig. 1C*).

*Basic environmental testing procedures for electronic and electrical items: Part 1 General.

- b) Bending (tag termination) (*see 7.2.2*) — The termination shall be capable of being bent with the fingers.

4. GENERAL DESCRIPTION OF BENDING TEST

4.1 Bending (Wire or Strip Terminations) — With the termination in its normal position, the component is held by its body in such a manner that the axis of the termination is vertical; a mass is then suspended from the end of the terminations.

The body of the component is then inclined through an angle of approximately 90° in the vertical plane and then returned to its initial position; this operation constitutes one bend.

Method 1 — Two or more bends in opposite direction.

Method 2 — Two or more bends in the same direction.

4.2 Bending (Tag Terminations) — Tag terminations, capable of being bent with the fingers, shall be bent through 45° and then returned to their initial position; this operation constitutes one bend.

Method 1 — Two bends in opposite direction.

Method 2 — Two bends in the same direction.

4.3 Simultaneous Bending — All the terminations on one side of the component shall be held, at a point 3 mm from the seal between the termination and the body of the component, in a clamp. A mass shall be attached to the clamp with the terminations pointing downwards.

The body of the component is then inclined through an angle of 45° and returned to its initial position. The test shall be performed in two opposite directions.

5. PRECONDITIONING

5.1 The method of preconditioning shall be as prescribed in the relevant specification.

6. INITIAL MEASUREMENTS

6.1 The item shall be visually inspected, and electrically and mechanically checked as required by the relevant specification.

7. TEST METHOD

7.1 Application — The relevant specification shall state whether this test is applicable.

When applicable, the test shall be carried out on all the terminations, except that where a component has more than three terminations, the specification shall state the number of terminations per component to be tested. The test shall be carried out in such a manner that all the terminations of the component shall have an equal probability of being subjected to the test.

This limitation in the number of terminations tested does not apply to simultaneous bending (see 7.2.3) which is generally applicable to certain types of microelectronic packages with several terminations in line on one or more sides.

7.2 Procedure (see Fig. 1)


7.2.1 Bending (Wire or Strip Terminations) — With the termination in its normal position, the component is held by its body in such a manner that the axis of the termination is vertical; a mass applying a force of the value given in Table 1 is then suspended from the end of the termination.

TABLE 1 VALUES OF FORCE

(Clauses 7.2.1 and 7.2.3)

SECTION MODULUS	DIAMETER OF CORRESPONDING ROUND LEADS	FORCE
(1) mm ³	(2) mm	(3) N
$Z_x \leq 1.5 \times 10^{-3}$	$d \leq 0.25$	0.5
$1.5 \times 10^{-3} < Z_x \leq 4.2 \times 10^{-3}$	$0.25 < d \leq 0.35$	1.25
$4.2 \times 10^{-3} < Z_x \leq 1.2 \times 10^{-2}$	$0.35 < d \leq 0.5$	2.5
$1.2 \times 10^{-2} < Z_x \leq 0.5 \times 10^{-1}$	$0.5 < d \leq 0.8$	5
$0.5 \times 10^{-1} < Z_x \leq 1.9 \times 10^{-1}$	$0.8 < d \leq 1.25$	10
$Z_x > 1.9 \times 10^{-1}$	$d > 1.25$	20

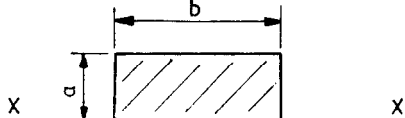
NOTE — For round terminations, the section modulus is given by the following formula:

$$Z_x = \frac{\pi d^3}{32}$$


where

d = lead diameter.

For strip terminations, the section modulus is given by the following formula:

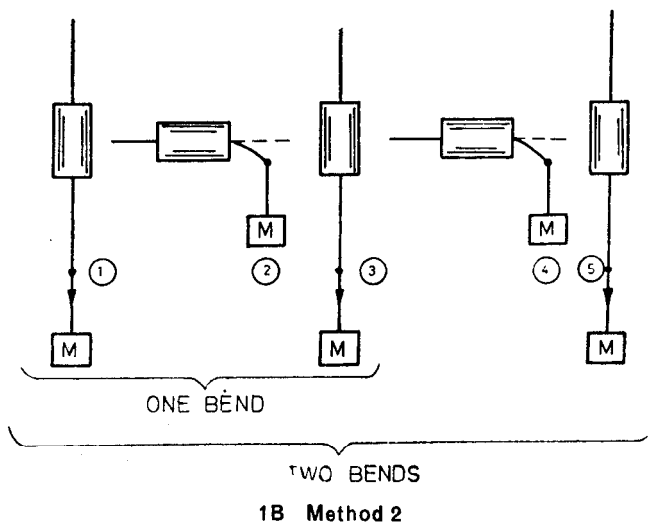
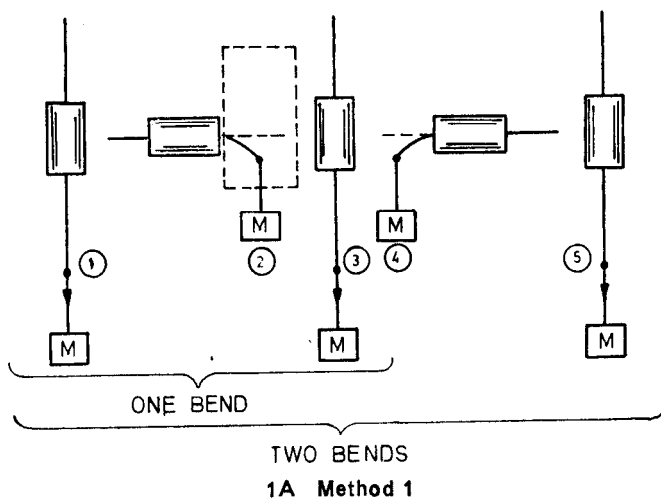
$$Z_x = \frac{ba^2}{6}$$


where

a = thickness of the rectangular strip perpendicular to the bending axis,

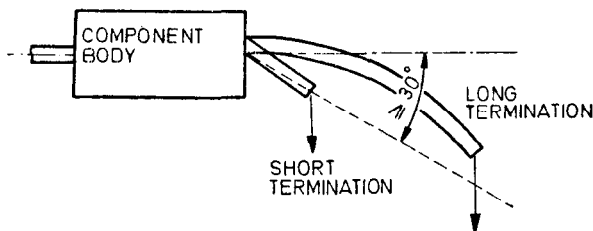
b = other dimension of the rectangular strip, and

Z_x = section modulus.



NOTE — For manual bending, see 7.2.2. The numbered sequence shall be followed.

FIG. 1 SKETCHES SHOWING TEST PROCEDURE FOR
TEST UB : BENDING — *Contd*



1C Detail Sketch Showing Angle of Displacement for Pliable Terminations

FIG. 1 SKETCHES SHOWING TEST PROCEDURE FOR TEST Ub : BENDING

The body of the component is then inclined (over a period of 2 to 3 s) through an angle of approximately 90° in the vertical plane and then returned to its initial position over the same period of time this operation constitutes one bend.

The test shall be performed according to the relevant specification, in accordance with any of the following procedures:

- a) *Method 1* (see Fig. 1A) — One bend followed by a second bend in the opposite direction or a larger number of alternate bends where prescribed in the relevant specification.
- b) *Method 2* (see Fig. 1B) — Two bends in one direction only without interruption or a greater number of bends, where prescribed in the relevant specification. No device capable of imposing a radius of curvature shall be placed between the body of the component and the point of application of the force. Strip terminations shall be bent perpendicularly to the widest surface of the strip.

The value of the force to be applied is given in Table 1 (applicable to Method 1 and 2).

7.2.2 Bending (Tag Terminations) — Tag terminations, capable of being bent with the fingers, shall be bent through 45° and then returned to their initial position; this operation shall constitute one bend (see Fig. 1).

The test shall be performed according to the relevant specification, stipulating one or the other of the following procedures:

- a) *Method 1* — One bend immediately followed by a second bend in the opposite direction.

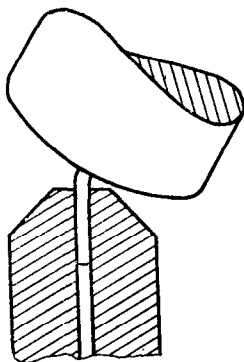
- b) *Method 2* — Two bends in the same direction, without interruption. The relevant specification may stipulate other details (such as use of pliers, place of bending, etc).

7.2.3 Simultaneous Bending — All terminations on one side of the component shall be clamped at the seating place or, where it is not given, at a point approximately 3 mm from the seal between the termination and the body of the component, in a clamp with a radius of 0.1 mm at the edge where bending will occur. A mass shall be attached to the clamp with the terminations pointing downwards. This mass, which shall include the mass of the clamp, shall apply a force equal to that given in Table 1 multiplied by the number of leads clamped.

The body of the component is then inclined through an angle of 45°, taking 2 to 3 s for the operation, and returned to its initial position over the same period of time. The test shall be performed once in one direction, returned to normal, and once in the opposite direction and again returned to normal (*see* Fig. 1).

NOTE — For the testing of short terminations, the clamp should be so designed that its upper surface will not touch the body of the component during the bending (which would cause a tensile stress on the terminations).

See figure below:



8. FINAL MEASUREMENTS

8.1 The item shall be visually inspected, and electrically and mechanically checked as required by the relevant specification.

9. INFORMATION TO BE GIVEN IN THE RELEVANT SPECIFICATION

9.1 When this test is included in the relevant specification, the following details shall be given as far as they are applicable:

- a) Preconditioning procedure, if any (*see 5*);
- b) Initial measurements (*see 6*);
- c) Whether the test is applicable (*see 7.1*);
- d) Number of terminations to be tested, if there are more than three (*see 7.1*);
- e) Method and number of bends, if more than two (*see 7.2.1*);
- f) Method and particular details of application (*see 7.2.2*);
- g) Final measurements (*see 8*); and
- h) Any deviation in procedure as agreed upon between the purchaser and the manufacturer.

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Indian Standard

BASIC ENVIRONMENTAL TESTING PROCEDURES FOR ELECTRONIC AND ELECTRICAL ITEMS

PART 19 TEST U : ROBUSTNESS OF TERMINATIONS AND INTEGRAL MOUNTING DEVICES

Section 4 Test Uc : Torsion

(First Revision)

1. SCOPE

1.1 This standard (Part 19/Sec 4) (First Revision) covers the test procedure for determining the ability of terminations and integral mounting devices to withstand torsional forces that are likely to be applied during normal assembly or dismantling operations.

NOTE — This is applicable only to devices with axial wire terminations.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions and explanation of terms given in IS : 9000 (Part 1)-1977* shall apply.

3. OBJECT

3.1 The object of this test is to determine that terminations and the attachment of the terminations to the body of the component shall withstand torsional forces such as are likely to be applied during normal assembly or dismantling operations.

4. GENERAL DESCRIPTION OF TORSION TEST

4.1 Each termination is bent through 90° at a point 6 to 6.5 mm from the point of emergence of the termination.

*Basic environmental testing procedures for electronic and electrical items: Part 1 General.

The free end of the termination shall be clamped up to a point 1.2 ± 0.4 mm from the bend. The body of the component or the clamping device shall then be rotated about the original axis of the termination at a rate of one rotation per 5 s. Successive rotations shall be in alternate senses.

5. PRECONDITIONING

5.1 The method of preconditioning shall be as prescribed in the relevant specification.

6. INITIAL MEASUREMENTS

6.1 The item shall be visually inspected, and electrically and mechanically checked as required by the relevant specification.

7. TEST METHOD

7.1 Application — The relevant specification shall state whether this test is applicable.

When applicable, the test shall be carried out on all the terminations, except that where a component has more than three terminations, the specification shall state the number of terminations per component to be tested. The test shall be carried out in such a manner that all the terminations of the component shall have an equal probability of being subjected to the test.

7.2 Procedure

7.2.1 Each termination shall be bent through 90° at a point 6 to 6.5 mm from the point of emergence of the termination. The radius of curvature of the bend shall be approximately 0.75 mm (see Fig. 1A).

The free end of the termination shall be clamped up to a point 1.2 ± 0.4 mm from the bend (see Fig. 1B). The body of the component or the clamping device shall then be rotated, as specified below, about the original axis of the termination at a rate of one rotation per 5 s. Successive rotations shall be in alternate senses.

The test shall be performed in accordance with one of the following procedures, and one of the following severities, as required by the relevant specification:

Method A

Component body clamped:

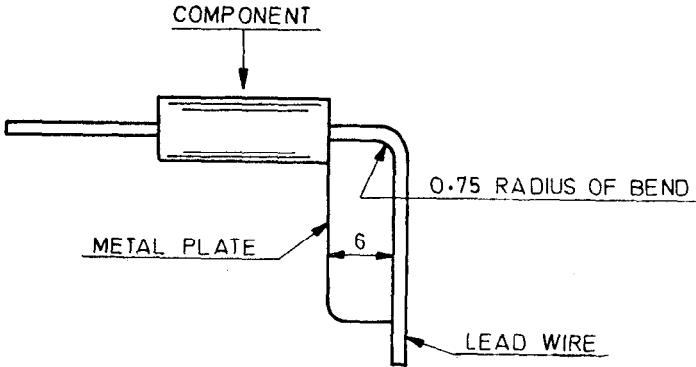
- Severity 1 : three rotations of 360° .
- Severity 2 : two rotations of 180° .

Method B

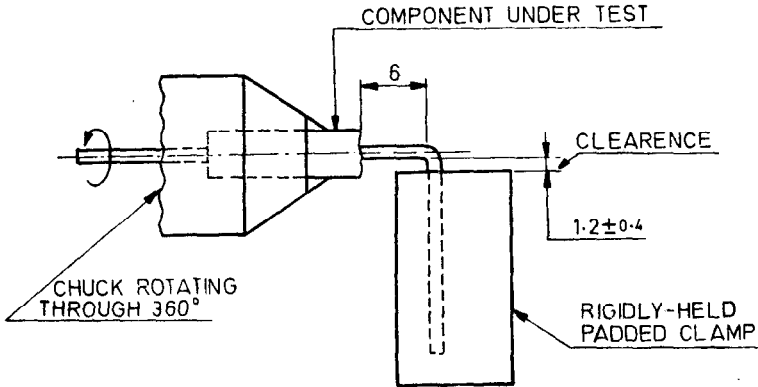
Both wire terminations clamped (see Fig. 1C):

— Two rotations of 180°.

NOTE — Method B is primarily intended for components with a body unsuitable for clamping (for example, having a diameter less than 4 mm) and with axial terminations of the same kind at each end.



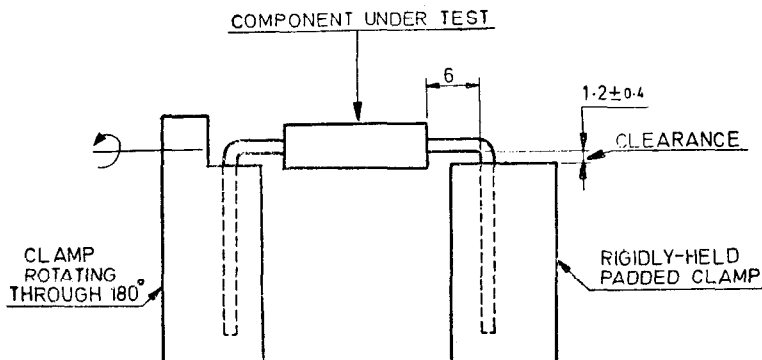
1A Method of Bending Wire Leads for the Torsion Test



All dimensions in millimetres.

1B Method of Twisting Wire Leads for the Torsion Test

FIG. 1 SKETCHES SHOWING TEST PROCEDURES FOR TEST UC :
TORSION TEST FOR WIRE TERMINATIONS — *Contd*



All dimensions in millimetres.

1C Method of Twisting Wire Leads for the Torsion Test on Components with a Body Unsuitable for Clamping

**FIG. 1 SKETCHES SHOWING TEST PROCEDURES FOR TEST Uc :
TORSION TEST FOR WIRE TERMINATIONS**

8. FINAL MEASUREMENTS

8.1 The item shall be visually inspected, and electrically and mechanically checked as required by the relevant specification.

9. INFORMATION TO BE GIVEN IN THE RELEVANT SPECIFICATION

9.1 When this test is included in the relevant specification, the following details shall be given as far as they are applicable:

- a) Preconditioning procedure, if any (see 5);
- b) Initial measurements (see 6);
- c) Whether this test is applicable (see 7.1);
- d) Number of terminations to be tested if more than three (see 7.1);
- e) Method A or B (see 7.2.1);
- f) Required severity 1 or 2 for Method A (see 7.2.1);
- g) Final measurements (see 8); and
- h) Any deviation in procedure as agreed upon between the purchaser and the manufacturer.

Indian Standard

BASIC ENVIRONMENTAL TESTING PROCEDURES FOR ELECTRONIC AND ELECTRICAL ITEMS

PART 19 TEST U : ROBUSTNESS OF TERMINATIONS AND INTEGRAL MOUNTING DEVICES

Section 5 Test Ud : Torque

(First Revision)

1. SCOPE

1.1 This standard (Part 19/Sec 5) (First Revision) covers the test procedure for determining the ability of terminations and integral mounting devices to withstand torque forces that are likely to be applied during normal assembly or handling operations.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions and explanation of terms given in IS : 9000 (Part 1)-1977* shall apply.

3. OBJECT

3.1 The object of this test is to determine that the terminations, the attachment of the terminations to the body of the component and integral mounting means will withstand torque forces such as are likely to be applied during assembly or handling operations.

4. GENERAL DESCRIPTION OF TORQUE TEST

4.1 For terminations with threaded studs or screws the torque given in Table 1 is applied to the screw or to each of the nuts normally fitted to each terminal for a period of 10 to 15 s according to the severity prescribed in the relevant specification.

*Basic environmental testing procedures for electronic and electrical items: Part 1 General.

During this test, a washer or metal plate with a normal clearance hole for the screw thread shall be placed between the screw head and the surface on to which it is tightened.

For other types of termination the relevant specification shall give the method required.

TABLE 1 VALUES OF TORQUE

(Clauses 4.1 and 7.2.1)

NOMINAL THREAD DIAMETER (mm)		2.6	3.0	3.5	4.0	5.0	6.0
Torque (Nm)	Severity 1	0.4	0.5	0.8	1.2	2.0	2.5
	Severity 2	0.2	0.25	0.4	0.6	1.0	1.25

5. PRECONDITIONING

5.1 The method of preconditioning shall be as prescribed in the relevant specification.

6. INITIAL MEASUREMENTS

6.1 The item shall be visually inspected, and electrically and mechanically checked as required by the relevant specification.

7. TEST METHOD

7.1 Application — The relevant specification shall state whether this test is applicable.

When applicable, the test shall be carried out on all the terminations, except that where a component has more than three terminations, the specification shall state the number of terminations per component to be tested. The test shall be carried out in such a manner that all the terminations of the component shall have an equal probability of being subjected to the test.

7.2 Procedure

7.2.1 Termination with Threaded Studs or Screws — With the component held by its normal fixing device, the torque given in Table 1 shall be gradually applied (without shock) to the screw or to each of the nuts normally fitted to each termination for a period of 10 ± 15 s according to the severity prescribed by the relevant specification.

During this test, a washer or metal plate with a normal clearance hole for the screw thread shall be placed between the screw head and the surface on to which it is tightened.

The thickness of the washer or metal plate shall be approximately equal to six times the nominal pitch of the stud. The nut thickness shall be equal to approximately 0.8 times the stud diameter as given in the relevant specification. All parts should be clean and dry.

For some components, such as semiconductor devices, very different torque values may be needed. Where necessary, these shall be prescribed in the relevant specification.

For diameters greater than 6 mm, the torque values shall be prescribed by the relevant specification.

The nuts or screws shall be capable of being loosened afterwards.

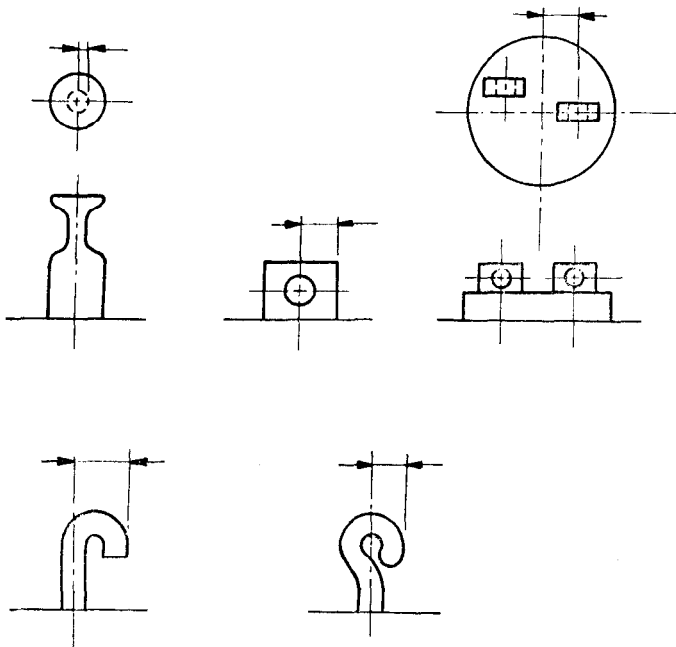
7.2.2 Non-wire Rigid Terminations — The relevant specification shall specify the value of torque from Table 2 based on the equivalent diameter of the external portion of the termination assembly. The equivalent diameter is defined as equal to twice the distance from the termination axis to the point of normal wire connection as shown in Fig. 1.

TABLE 2 VALUES OF TORQUE

EQUIVALENT DIAMETER	TORQUE
(1)	(2)
mm	mN.m
Up to 1.6	0
1.7 to 3.2	56.5
3.3 to 4.8	127.1
4.9 to 7.9	282.5
8.0 to 12.7	565.0
Greater than 12.7	As specified in the relevant component specification

The method of application and duration of the torque shall be as specified in 7.2.1 unless otherwise specified in the relevant component specification.

7.2.3 Other Types of Termination — The relevant specification shall give the methods required.



NOTE— Equivalent diameter is twice the distance between the lines indicated by arrows.

FIG. 1 METHOD OF DETERMINING EQUIVALENT DIAMETER FOR TEST Ud : TORQUE (NON-WIRE RIGID TERMINATION) TEST

8. FINAL MEASUREMENTS

8.1 The item shall be visually inspected, and electrically and mechanically checked as required by the relevant specification.

9. INFORMATION TO BE GIVEN IN THE RELEVANT SPECIFICATION

9.1 When this test is included in the relevant specification, the following details shall be given as far as they are applicable:

- Preconditioning procedure, if any (see 5);
- Initial measurements (see 6);
- Whether this test is applicable (see 7.1);

- d) Number of terminations to be tested, if more than three (*see 7.1*);
- e) Severity (*see 7.2.1 and 7.2.2*);
- f) Different torque values for thread diameters greater than 6 mm or if necessary for other reasons (*see 7.2.1*);
- g) Test method for other types of terminations (*see 7.2.3*);
- h) Final measurements (*see 8*); and
- j) Any deviation in procedure as agreed upon between the purchaser and the manufacturer.

(Continued from page 2)

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